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M.S. in Electrical Engineering, 1955, and Ph.D., 1963, Technische Hochschule, Munich, Germany. Worked at the Computer Center of the Technische Hochschule in Munich as Development Engineer and Head of the Technical Staff from 1956-63. Joined IBM at the Thomas J. Watson Research Center in 1963 where he has worked on the development of high-speed magnetic film memories. His present activity at the Research Center is in the field of general memory research. Received the NTG Award, 1964, of the Nachrichten Technische Gesellschaft (Germany). Member, Nachrichten Technische Gesellschaft.

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B.S. in Engineering Physics, 1954, University of Maine. Joined IBM, Endicott, 1954, worked on vacuum deposition techniques and measurements of thin photoconductors, insulators, conductors, and magnetic materials. In 1960-61 worked on magnetic film memory device and process in the IBM Research Laboratory at Zurich, Switzerland. Presently at the Systems Development Division Laboratories in Poughkeepsie, where he is manager of an advanced technology group concerned with development of devices and processes for thin magnetic film computer elements. Recipient of three IBM Patent Awards. Senior Member, IEEE; Member, American Vacuum Society.

George F. Bland

Sc.B. in Engineering, 1948, Brown University; M.S. in Electrical Engineering, 1950, University of Illinois; Professional Degree in Electrical Engineering, 1957, Columbia University. Joined the IBM Engineering Laboratories in Poughkeepsie in 1950 and was active in electrostatic memory development. Is currently at the IBM Thomas J. Watson Research Center, Yorktown, where he has headed several projects including an investigation of transmission line phenomena pertinent to memory and logic hardware and the 60 nsec flat film memory. At present he is manager of a group that is investigating techniques for automatically analyzing and testing the dynamic behavior of multicircuit logic units. Member, IEEE, Sigma Xi and Eta Kappa Nu.

Paul T. Chang

M.S. in Physics, 1956, University of Michigan. On educational leave at Syracuse University for an advanced degree in physics. Previously employed in research and development by Curtiss Wright Corp. and Daystrom Inc. Joined IBM in 1961 to work in an advanced optics group at the Poughkeepsie laboratories. Currently employed at the Systems Development Division Laboratory in Poughkeepsie in the area of Advanced Recording Technology, working on problems involving beam interactions with magnetic materials. Member of RESA.

James E. Dammann

A.B., University of Illinois, 1956; M.S., University of Michigan, 1958; Ph.D. in Communication Sciences, 1964, University of Michigan. Joined IBM Development Laboratory, Poughkeepsie, in 1959 to begin work in the area of com-

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Lawrence J. Giacoletto

B.S., in Electrical Engineering, Rose Polytechnic Institute; M.S. in Physics, State University of Iowa; Ph.D. in Electrical Engineering, University of Michigan. Was on military duty for five years with the Signal Corps Engineering Laboratories working on development of radio, navigational, and meteorological direction finding equipment. After military service joined RCA Laboratories, Princeton, as Research Engineer in electronic and semiconductor devices. In 1956, became Manager of the Electronics Department of the Ford Motor Company Scientific Laboratory where he directed a broad program of scientific research into advanced electronic instrumentation, physical electronics and electrical systems. Since 1960 has been on the faculty of Michigan State University as Professor in Electrical Engineering. Fellow, IEEE and American Association for the Advancement of Science; member, American Physical Society. Member of the IEEE Board of Directors and Editorial Review Committee of the Proceedings of the IEEE.

Clifford E. Herrick, Jr.

Sc.B. in Chemistry, Brown University, 1938; Ph.D. in Photochemistry, University of Rochester, 1943. From 1942-1945 he worked on the Manhattan Project at Columbia University on exchange equilibria and diffusion barrier problems. In 1946 Dr. Herrick joined the Central Laboratory of General Aniline and Film Corporation in Easton, Pennsylvania, becoming Ozalid Group Leader in 1948. In 1950 he was transferred to the Ozalid Division in Johnson City, New York, as Research Department Head, and in 1958 was appointed Director of Research for the Ozalid Division. In 1960 he joined Sumner Williams Incorporated, manufacturer of offset plates, as Vice President and Director of Research. He joined IBM in 1963 as Chemistry Department Manager at the San Jose Research Laboratory. Dr. Herrick is the author of several technical papers and holds some 30 U. S. patents, largely in the field of light-sensitive processes and related materials. Fellow of the American Association for the Advancement of Science and the American Institute of Chemists; member of the American Chemical Society, American Institute of Physics, Optical Society of America, Society of Photographic Scientists and Engineers, and the New York Academy of Sciences.

Hans G. Hottenrott

B.A. in Physics, 1956, New York University; M.S. in Physics, 1958, Syracuse University. Joined IBM at the Poughkeepsie Development Laboratory in 1958 and was engaged in ferrite and magnetic thin film memory device development and characterization. Is presently working on the development of high-speed ferrite core memories at the Systems Development Division Laboratory, Poughkeepsie. Member of Sigma Xi.

David P. Kennedy

Member of Radiation Laboratory, MIT, 1940-42, engaged in the design of radar equipment. From 1942-58 was employed by Raytheon Manufacturing Company as a Senior Engineer, working in the fields of microwave tubes, microwave communication systems, and semiconductor devices. Instructed at the Graduate School of Engineering, Northeastern University, 1953-58. Joined the IBM Development Laboratory, Data Systems Division, Poughkeepsie, in 1958 as an Advisory Physicist in the mathematical analysis of boundary value problems, relating to the design and development of semiconductor devices. Is presently a Senior Physicist and Manager of Semiconductor Device Theory in the Components Department of the Systems Development Division at East Fishkill. Member, American Physical Society.

John H. King, Jr.

B.S.E.E., 1955, Newark College of Engineering. From 1955-57 was concerned with speech communication problems under adverse environmental conditions as an Air Force R and D Officer at Wright Air Development Center. From 1957-60 while with ITT Laboratories did development work on various radio navigation systems. Since joining IBM in 1960 at the Systems Development Division Laboratories, Endicott, has been concerned with the development of methods for adaptive design of pattern recognition systems with a side interest in speech recognition. Member, IEEE professional groups on Audio, Information Theory, and Electronic Computers.

Herbert J. Kump

B.S. in Physics, 1951, Pennsylvania State University; M.E.E., 1960, Syracuse University. Joined IBM at Endicott in 1955 and worked in the magnetic recording and storage fields. Was engaged in the development of a magnetic thin film memory in the Components Division at Poughkeepsie. Presently engaged in the development of advanced magnetic memory systems for the Systems Development Division in Burlington. Received an Outstanding Invention Award for contributions in magnetic recording in 1963 and an Invention Achievement Award in 1964.

William E. Langlois

Sc.B. in Physics, 1953, Notre Dame; Ph.D. in Applied Mathematics, 1957, Brown University. From 1956-59, research engineer at the Polychemicals Department, E. I. duPont de Nemours & Company, concentrating on hydrodynamics of non-Newtonian fluids. Joined IBM in 1959 and is now studying meteorology at the IBM Research Laboratory at San Jose. He is the author of the hydrodynamics monograph *Slow Viscous Flow* published by the Macmillan Company, 1964.

Reginald F. Lever

B.A. in Physics, 1951, Oxford University. Scientific Officer at the Service Electronics Research Laboratory, Baldock, England 1951-57. Spent one year at the Culcheth Laboratory of the United Kingdom Atomic Energy Authority (Industrial Group). In 1958-60 was with the Research Division of the Philco Corporation, Philadelphia. Joined IBM Research Division in 1960 and has recently been concerned with the study of epitaxial growth by chemical reaction techniques at the Thomas J. Watson Research Center, Yorktown Heights. Member of American Physical Society.

Philip C. Murley

B.A. in Mathematics, 1956, Northwestern University; M.S. in Mathematics, 1957, University of Illinois. Joined IBM in 1957 as a programmer in the Scientific Computation Department of the Data Systems Division, Poughkeepsie. Transferred in 1961 to the Components Division to do mathematical analysis and programming relating to semiconductor device theory. Now at Systems Development Division, East Fishkill.

Peter Pleshko

B.E.E., 1956; M.E.E., 1958, City College of New York. Has worked at Kearfott and International Telephone and Telegraph Company on assignments involving design and development of transistorized digital circuits for logic and core memories and tunnel diode logic and memory circuits. Since joining IBM in 1963 at the Thomas J. Watson Research Center, has worked on circuits for high speed film memories.

Frederick A. Reid

B.S.E.E., 1959, University of California at Berkeley; graduate study, 1959, Syracuse University. From 1956-57, was employed at the Instrument Division of Varian Associates, Palo Alto, California. Joined IBM in the Semiconductor Development Department at Poughkeepsie in July, 1959. From 1960-64 worked in advanced semiconductor applications, and from 1964 to 1965, in advanced logic technology development. Was Manager, Packaging Evaluation at the Systems Development Division Laboratories, East Fishkill. Is now at Systems Development Division, Sunnyvale, Calif. Member, Tau Beta Pi and IEEE.

Elisabeth M. Rutz, née Philipp

B.S., M.S. and D.Sc. 1946 in Applied Physics, Technical University of Vienna. Joined IBM in 1961 and is presently an Advisory Engineer in the Washington Systems Center of the Federal Systems Division at Bethesda. Engaged in applied research of microwave solid-state devices and space antennas.

Paul E. Stuckert

A.B., 1948, Valparaiso University; B.S.E.E., 1947 and M.S.E.E., 1948, Purdue University. Employed by Indiana Steel and Wire Co., Muncie, Indiana, 1948-50 and Westinghouse Electronics Division, Baltimore, 1950-56. Joined IBM in 1956 for work in magnetic core logic and subsequent research in tunnel diode and magnetic memory elements. Presently engaged in development of automatic test equipment at the Thomas J. Watson Research Center.

Cyril J. Tunis

B. Eng. in Engineering Physics, 1954, and M.Sc. in Physics, 1956, McGill University; Ph.D. in Electrical Engineering, 1958, Manchester University, Manchester, England. Joined IBM at Endicott in 1958. Involved in digital systems organization, switching circuits, logic design, adaptive threshold circuits, memory development. Presently Manager of Advanced Electrical Technology in the Systems Development Division Laboratory in Endicott. Member, IEEE.

Contents of previous two issues

July 1965

Vol. 9, No. 4

• Communications Articles:

- On Communications and Data Processing:
A Foreword
by *M. C. Andrews*226
- A New Approach to Time-Domain Equalization
by *E. Gorog*228
- Decoding of Cyclic Codes Using
Position Invariant Functions
by *J. D. Ullman*233
- A Comparison of Pseudo-Noise and
Conventional Modulation for
Multiple-Access Satellite Communications*
by *H. Blasbalg*241
- A Pulsed Pseudo-Noise VHF Radio Set
by *F. Corr, R. Crutchfield and J. Marchese*256
- Analysis and Simulation of a
Digital Matched Filter Receiver of
Pseudo-Noise Signals
by *R. Van Blerkom, R. E. Sears and
D. G. Freeman*264
- Design of an Automatic Telephone Intercept Switch
by *G. F. Abbott, R. L. Bence, J. A. Ceonzo and
J. M. Regan*274
- Filter Performance in
Integrated Switching and Multiplexing
by *K. M. Roehr, P. M. Thrasher and
D. J. McAuliffe, Jr.*282

• Short Communication:

- On Definitions of a Burst
by *R. T. Chien and D. T. Tang*292
- Regular Articles:
A Technique for Determining and Coding Sub-
classes in Pattern Recognition Problems
by *R. L. Mattson and J. E. Dammann*294
- Thermal Problems of the Injection Laser
by *R. W. Keyes*303
- Properties of GaAs Diodes with P-P⁰-N Structures
by *K. Weiser*315
- Vapor-Phase Polishing of Silicon with
H₂-HBr Gas Mixtures
by *L. V. Gregor, P. Balk, F. J. Campagna*327

• Short Communications:

- Two-Dimensional Laser Deflection
Using Fourier Optics
by *H. J. Zweig*333
- Fatigue Strength of Case Hardened Steel
Specimens Containing Through-The-Case Cracks
by *W. D. Kehr*336

*Errata:

A Comparison of Pseudo-Noise and Conventional Modulation for Multiple-Access Satellite Communications, by *H. Blasbalg*

1. Page 243—paragraph 2—under sub-heading *Conventional Modulation Techniques*—should read as follows:
“PCM-TDM requires synchronization of the ground stations so that all pulsed transmissions arrive at the satellite in an unoccupied time slot. Here the repeater can be nonlinear.”
2. Page 250, Figure 7: The figure heading should read—
“Intrinsic signal-to-noise ratio vs number of channels per megacycle for phase shift keyed binary signals (solid line) and orthogonal or on-off binary signals (dashed line).”